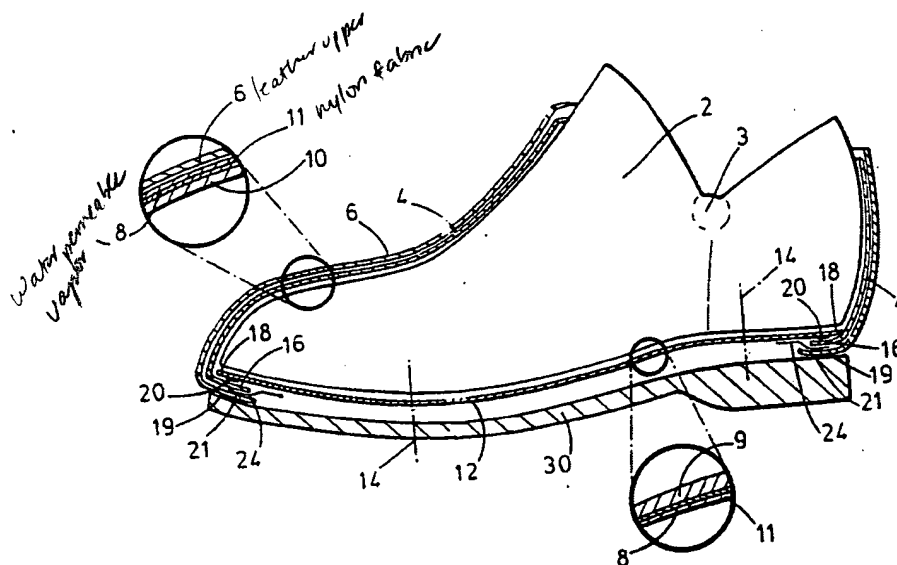




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : A43B 7/12, 9/12	A1	(11) International Publication Number: WO 93/16612 (43) International Publication Date: 2 September 1993 (02.09.93)
(21) International Application Number: PCT/GB93/00370 (22) International Filing Date: 22 February 1993 (22.02.93) (30) Priority data: 9203714.2 21 February 1992 (21.02.92) GB (71) Applicant (for all designated States except US): W.L. GORE & ASSOCIATES (UK) LTD. [GB/GB]; 1 Bell Yard, London WC2A 2JP (GB). (72) Inventors; and (75) Inventors/Applicants (for US only) : BASTIANELLI, Peter, Duncan [GB/GB]; 42 Bankton Park West, Muirieston, Livingston EH54 9BP (GB). SIMPSON, Peter [GB/GB]; The Tecnic Shoe Co. Ltd., Bedford Road, Rushden, Northamptonshire NN10 0ND (GB).		(74) Agents: McCALLUM, William, Potter et al.; Cruikshank & Fairweather, 19 Royal Exchange Sq., Glasgow G1 3AE (GB). (81) Designated States: AU, CA, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: FOOTWEAR**(57) Abstract**

An item of footwear which is impermeable to liquid water but is water-vapour-permeable comprises: an inner lining comprising an upper portion (4) and a midsole (12); the upper portion being formed of a laminate comprising an inner lining material (10) and an outer water-impermeable water-vapour-permeable layer (8); and the midsole being formed of an inner midsole board (9) laminated to an outer water-impermeable water-vapour-permeable layer (8); the upper portion having an entrance for a foot and a lower lasting margin (16), the lasting margin being folded around the periphery of the midsole so as to overlap the midsole periphery and being attached thereto so as to form a seam; and the water-impermeable water-vapour-permeable layer of said lasting margin being sealed to the water-impermeable water-vapour-permeable layer of the midsole. Usually the seam is sealed by adhering seam sealing tape over the seam. The water-impermeable water-vapour-permeable material may be expanded porous polytetrafluoroethylene.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NL	Netherlands
BE	Belgium	GN	Guinea	NO	Norway
BF	Burkina Faso	GR	Greece	NZ	New Zealand
BG	Bulgaria	HU	Hungary	PL	Poland
BJ	Benin	IE	Ireland	PT	Portugal
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SK	Slovak Republic
CI	Côte d'Ivoire	LJ	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	MC	Monaco	TG	Togo
DE	Germany	MG	Madagascar	UA	Ukraine
DK	Denmark	ML	Mali	US	United States of America
ES	Spain	MN	Mongolia	VN	Viet Nam
FI	Finland				

FOOTWEARFIELD OF THE INVENTION

The present invention relates to an item of footwear which is impermeable to liquid water (i.e. is waterproof) but is water-vapour-permeable so as to be comfortable to wear. The invention is particularly applicable to sports shoes, boots, slippers or socks.

BACKGROUND

Waterproof water-vapour-permeable materials are available from W.L. Gore & Associates under the trademark GORE-TEX. These comprise a thin membrane of porous polytetrafluoroethylene (PTFE) which may be produced in the manner described in US patent 3953566. Usually, the porous expanded PTFE membrane is coated with an oleophobic coating, as disclosed in US patent 4194041, in order to prevent the membrane from being wetted-out by fats or oils from the wearer's body. However, other waterproof water-vapour-permeable membranes are also available on the market and the invention is applicable to these also.

In order that the shoe shall be fully water tight, it has been conventional practice to initially produce a bootie of a relatively soft waterproof water-vapour-permeable material around which the shoe is constructed. The bootie includes an opening for the foot and is usually formed from two side portions and a sole

portion. The joins are generally butt-edged, secured with zig-zag stitching and sealed. The bootee can then be pretested for leaks before being put into the final shoe. Typically, the bootee is formed of a conformable four layer laminate comprising from the outside inwards, a layer of nylon knit, a membrane with oleophobic coating, a foam layer and an inner fabric lining to go adjacent the foot.

However, the flexible nature of the bootee can cause difficulty in subsequently aligning the bootee on a last in order to allow the upper and outer sole to be attached.

It is an object of the present invention to mitigate these problems.

SUMMARY OF THE INVENTION

The present invention provides an item of footwear which is impermeable to liquid water but is water-vapour-permeable which comprises;

- an inner lining comprising an upper portion and a midsole;
- the upper portion being formed of a laminate comprising an inner lining material and an outer water-impermeable water-vapour-permeable layer; and the midsole being formed of an inner midsole board laminated to an outer water-impermeable water-vapour-permeable layer;
- the upper portion having an entrance for a foot and

a lower lasting margin, the lasting margin being last d around the p riphery of the midsole so as to overlap the midsole periphery and being attached thereto so as to form a seam; and
-the water-impermeable, water-vapour-permeable layer of said lasting margin being sealed to the water-impermeable, water-vapour-permeable layer of the midsole.

The invention also extends to a process of production wherein the inner lining is formed on a last. The last is then withdrawn and the seam seal tape applied. The sealed inner lining is then returned to the last and an outer sole and upper applied. The outer uppers will be on the outside of the finished shoe. Alternatively the seam sealing tape may be applied while the inner lining is still on the last.

PREFERRED EMBODIMENTS

The inner lining is formed of laminated materials. The inner lining material of the upper portion is preferably a material having limited stretchability, such as leather, such that it requires to be formed on a last. The laminate is preferably formed by adhering the water-impermeable, water-vapour-permeable layer with adhesive under the application of pressure to the outside of the inner lining layer. Similarly, the midsole is preferably formed by adhering the water-impermeable,

water-vapour-permeable layer to the outside of a semi-rigid midsole board material. The water-impermeable, water-vapour permeable layer (such as expanded porous PTFE and oleophobic coating) is preferably protected on its outermost side with a loose knit fabric layer, which nevertheless allows penetration of adhesive used with the seam seal tape through to the water-impermeable, water-vapour-permeable layer for sealing purposes.

The upper portion of the lining is generally made in conventional manner from panels which are butt jointed and stitched; and the seams sealed with seam seal tape. At this stage, the upper (usually of leather) may be attached to the inner lining around the ankle area but is otherwise left loose to be lasted in later. However, in the case of a sock or slipper, an upper may not be required.

The water-impermeable water-vapour-permeable layer of the lasting margin may be sealed to the water-impermeable water-vapour-permeable layer of the midsole by means of a suitable adhesive (which will form a waterproof seal, which may or may not be water-vapour-permeable) or a gasketting material such as expanded porous PTFE tape impregnated with an adhesive placed between the lasting margin and the midsole. However, it is preferred to seal the seam by adhering seam seal tape over the seam in known manner.

The seam seal tape may be any suitable tape provided with an adhesive on its inner surface. It is often of the

same material as the water-impermeable water-vapour-permeable layer. It is preferably formed of a water-impermeable water-vapour-permeable expanded porous PTFE membrane having an oleophobic coating thereon.

Usually, a thermoplastic adhesive is attached to one side of the tape, whilst a protective fabric layer is applied to the other side. The seam seal tape may be applied by heating such as to melt the adhesive and applying under pressure.

The item of footwear will normally include an outer sole attached in conventional manner underneath the midsole of the inner lining.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

An embodiment of the present invention will now be described by way of example only with reference to the attached drawings wherein;

Figure 1 is a cross sectional elevation of a shoe according to the present invention on a last; and

Figure 2 is a partially cut away view of the shoe with the outer layer of the uppers and the outer sole omitted for clarity.

Figure 1 shows a last 2 of conventional construction having a hinge 3 to allow the heel portion to be hinged away to enable the last to be removed from a shoe. The last provides a former on which the shoe is built up. The shoe principally comprises an inner lining comprising a

lining upper portion 4 sealed to a midsole 12 by means of adhesive 20 and seam sealing tape 24. The lining upper portion 4 and midsole 12 are each formed of a laminate comprising a leather lining 10 and a midsole board 9 respectively, each being laminated to a layer 8 of water-impermeable, water-vapour-permeable expanded porous PTFE carrying an oleophobic coating and having on an outer surface thereof a knitted open nylon fabric 11 (a material available from W.L. Gore & Associates (UK) Ltd. under the trademark TOP-DRY). The laminate is arranged so that the porous expanded PTFE layer 8 and nylon fabric 11 are outermost. Around the outside of the lining is provided leather upper 6 adhered by hot melt adhesive 21 to the underside of the midsole. An outer sole 30 is attached to the base of the shoe.

The shoe is assembled in the following manner.

Firstly, the upper portion 4 of the inner lining is produced from panels of the leather laminate by seaming the panels together (for example, heel, vamp and tongue panels, or other construction known in the art) to construct a part-bag shape, stitching the panels together with a lock stitch, and applying a seam sealing tape under the effects of heat and pressure.

The seam sealing tape comprises water-impermeable, water-vapour-permeable expanded porous PTFE tape and oleophobic coating, having on one side a hot melt adhesive and on the other side a knitted fabric protective layer.

These seams are omitted from Figure 1 for clarity.

The leather upper 6, usually also formed in two halves, is then attached around the ankle portion of the inner lining and are folded upwards out of the way for the time being.

As particularly shown in Figure 2, the midsole laminate 12 is then attached by tacks 14 to the underside of the last 2.

Using conventional techniques, the upper lining portion 4 is lasted over the last so as to adopt its shape and a lower marginal portion 16 thereof is left protruding beyond the underside of the last. An adhesive layer 20 is applied around the periphery of the midsole and the marginal portion 16 of the lining upper portion 4 is folded around the underside of the midsole periphery and adhered thereto. This results in puckers 22 which may be removed, or alternatively avoided by scalloping the marginal portion 16.

The shoe assembly is now removed from the last. The tacks 14 are withdrawn and the holes left are sealed with patches 28 of seam sealing tape. The last is withdrawn by hinging the heel portion of the last in conventional manner. This allows seam sealing tape 24 to be applied over the seam 26 between the upper portion of the lining and the midsole. In the case of both the midsole and the upper portion of the inner lining, the expanded porous PTFE layer lies on the outer side of the leather lining 10.

The seam seal tape 24 is applied under heat and pressure such that the hot melt adhesive penetrates the nylon fabric 11 and securely adheres to the porous expanded PTFE membrane on either side of the seam 26, thereby sealing the seam against ingress of liquid water.

The sealed lining is then replaced over the last. The leather upper 6 (which was previously lifted upwards out of the way) is now pulled downwards over the last and in a second lasting process is conformed to the shape of the last and extends beyond the lower edge thereof so as to provide an overlap portion 19. A layer of hot melt adhesive 21 is then applied around the periphery of the midsole and over the seam sealing tape 24. The peripheral portion 19 (which may be skived to reduce its thickness) is then lasted around the lower edge of the inner lining and adhered thereto. Any folds or puckers formed in the overlap area 19 can be ground away in conventional manner.

The outer sole 30 may then be applied to the underside of the shoe in conventional manner.

CLAIMS

1. An item of footwear which is impermeable to liquid water but is water-vapour-permeable which comprises;
 - an inner lining comprising an upper portion (14) and a midsole (12);
the upper portion being formed of a laminate comprising an inner lining material (10) and an outer water-impermeable water-vapour-permeable layer (8);
and the midsole being formed of an inner midsole board (9) laminated to an outer water-impermeable water-vapour-permeable layer (8);
 - the upper portion having an entrance for a foot and a lower lasting margin (16), the lasting margin being folded around the periphery of the midsole so as to overlap the midsole periphery and being attached thereto so as to form a seam; and
 - the water-impermeable water-vapour-permeable layer of said lasting margin being sealed to the water-impermeable water-vapour-permeable layer of the midsole.
2. Footwear according to claim 1 wherein seam seal tape (24) is adhered over the seam such as to seal the water-impermeable water-vapour-permeable layer of the lasting margin to the water-impermeable water-vapour-permeable layer of the midsole.

3. Footwear according to claims 1 or 2 wherein the laminate forming the upper portion comprises an inner lining material (10) which is leather.
4. Footwear according to any preceding claim wherein the laminate forming the upper portion further comprises a fabric (11) laminated to the outside of the water-impermeable water-vapour-permeable layer.
5. Footwear according to any preceding claim wherein the water-impermeable water-vapour-permeable material comprises expanded porous polytetrafluoroethylene (ePTFE).
6. Footwear according to claim 5 wherein the inner surface of the ePTFE carries an oleophobic coating.
7. A process for the production of an item of footwear which is impermeable to liquid water but is water-vapour-permeable which comprises
 - (a) forming on a last an inner lining comprising an upper portion and a midsole, the upper portion being formed of a laminate comprising an inner lining material and an outer water-impermeable water-vapour-permeable layer; and the midsole being formed of an inner midsole board laminated to an outer water-impermeable water-vapour-permeable layer, the upper portion having an entrance for a foot and a lower lasting margin;

(b) folding the lasting margin around the periphery of the midsole so as to overlap the midsole periphery and attaching thereto so as to form a seam;

(c) sealing the water-impermeable water-vapour-permeable layer of the lasting margin to the water-impermeable water-vapour-permeable layer of the midsole.

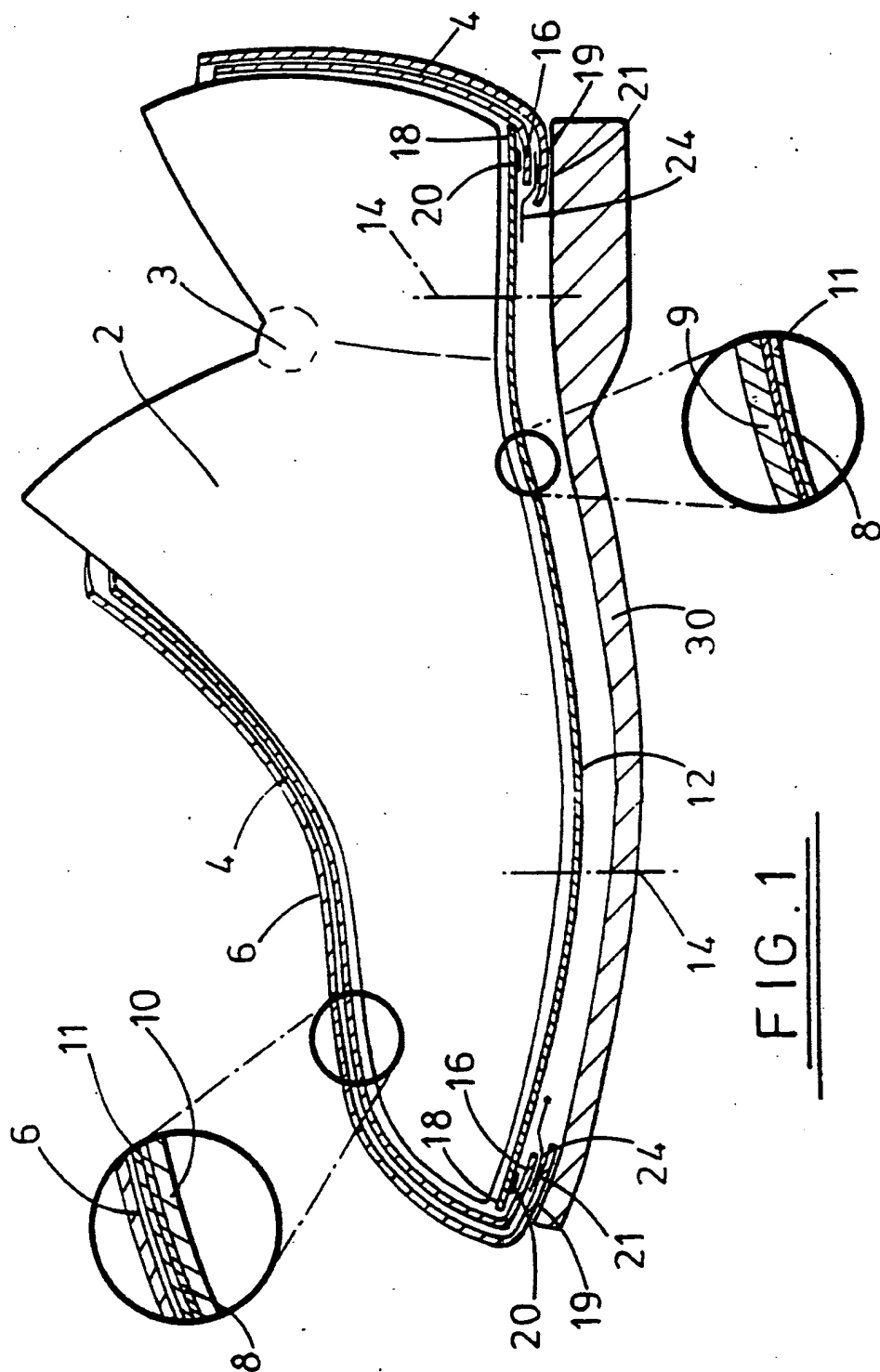


FIG. 1

2 / 2

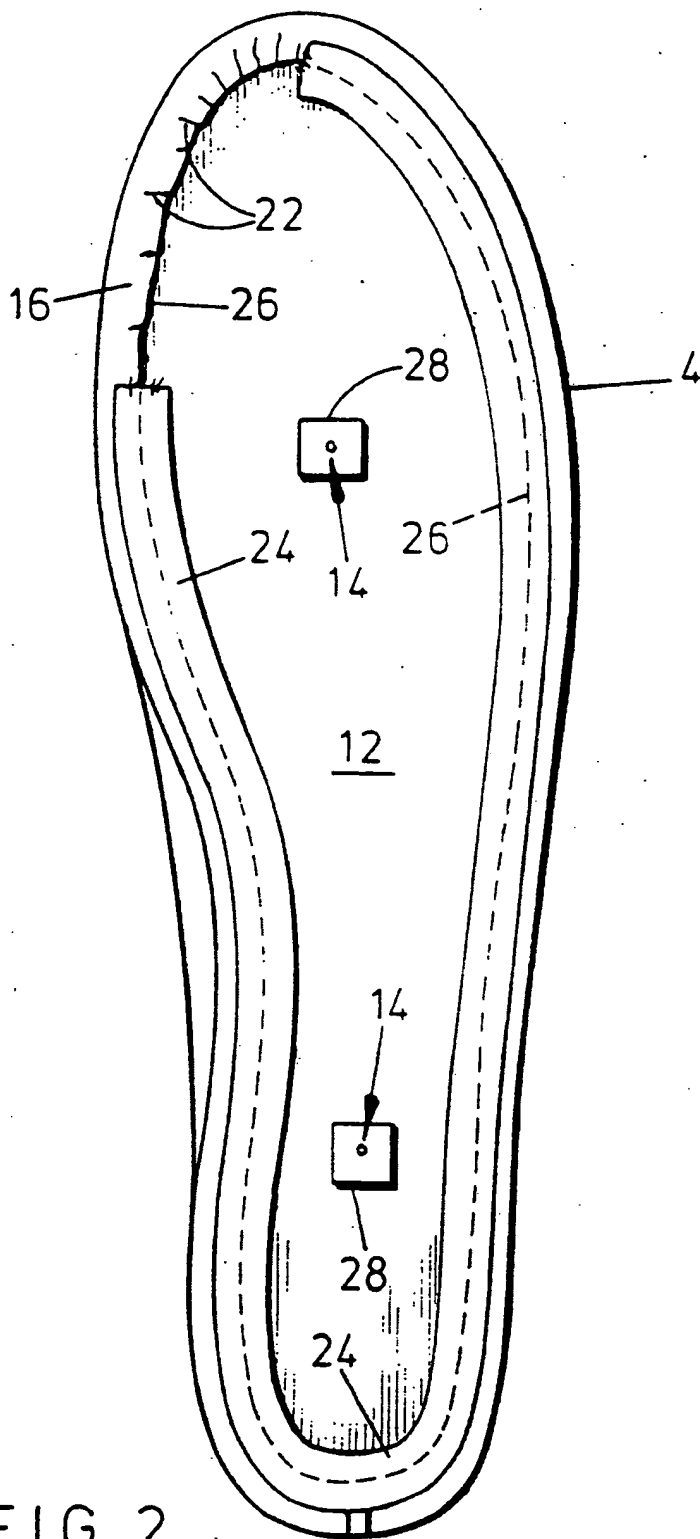


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 93/00370

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 A43B7/12; A43B9/12		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	A43B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	DE,A,4 002 667 (AUMANN) 13 June 1991 see the whole document ---	1-7
A	DE,A,4 000 156 (W.L. GORE & ASSOCIATES GMBH) 11 July 1991 see the whole document ---	1-7
A	EP,A,0 284 638 (KUK SCHUHFABRIK GMBH) 5 October 1988 see the whole document ---	1-7
A	EP,A,0 334 038 (AKZO N.V.) 27 September 1989 see the whole document ---	1-7
	-/--	
<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
26 MAY 1993	28 -06- 1993	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	SCHÖLVINCK T.S.	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US,A,4 194 041 (GORE ET AL) 18 March 1980 cited in the application see abstract -----	6

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9300370
SA 70364

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26/05/93

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-4002667	13-06-91	DE-U- 8914377	19-04-90
DE-A-4000156	11-07-91	None	
EP-A-0284638	05-10-88	None	
EP-A-0334038	27-09-89	US-A- 4819345 JP-A- 1262802	11-04-89 19-10-89
US-A-4194041	18-03-80	CA-A- 1112551 DE-A, C 2925318 DE-C- 2954263 FR-A, B 2429666 GB-A, B 2024100 JP-C- 1388850 JP-A- 55007483 JP-B- 60039014 NL-A- 7904783 SE-B- 445815 SE-A- 7902163	17-11-81 17-01-80 06-03-86 25-01-80 09-01-80 14-07-87 19-01-80 04-09-85 03-01-80 21-07-86 30-12-79